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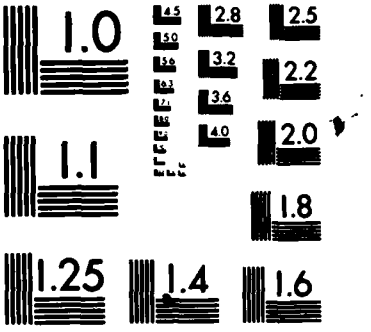

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HOSPITALIZATIONS FOR ACCIDENTS AND INJURIES IN THE U.S. NAVY: IV. A COMPARISON OF NUCLEAR AND CONVENTIONALLY POWERED SURFACE SHIPS

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Hospitalizations for Accidents and Injuries in the U.S. Navy: IV. A Comparison of Nuclear and Conventionally Powered Surface Ships

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SUMMARY

Problem

Occupational safety and health is of continuing concern to both private industry and the military. At present more than 2.5 million workdays are lost annually in the United States to injury and disease, with accidental injuries the leading cause of death and disability among men under age 35. Since the magnitude and severity of the risks of accidental injury depend upon the particular hazards associated with each occupation and work environment, and the protective and preventive measures in place to reduce such risks, interpretion of the relationship between these factors and host characteristics is needed to understand how they may contribute to accidents in the U.S. Navy.

Objective

The objective of this study was to provide detailed analyses of accidental injury-related hospitalizations as a function of the work environment, determining if duty aboard nuclear powered ships was more or less hazardous than duty aboard conventionally powered ships of the same type.

Approach

This study was conducted as a cross-sectional investigation covering the years 1977-1979. Participants included all male enlisted personnel who served exclusively aboard conventionally or nuclear powered aircraft carriers and cruisers. Cases were identified as those enlisted men who had suffered an accidental injury that resulted in a hospitalization, a Medical Board, a Physical Evaluation Board, or death ($N = 2704$). Additional classifications were available to further describe the circumstances of individual hospitalizations.

Results

The 20-24 year age group exhibited significant differences in injury risk for both conventional carrier and cruiser personnel rate comparisons. E1 personnel serving aboard conventional carriers and E4 personnel serving aboard conventional cruisers also showed significant rate differentials when compared to nuclear personnel in the same paygrades. Nearly 1/3 of all injury-related hospitalizations occurring among conventional and nuclear carrier personnel were distributed among the marine engineer and seaman job categories. These same occupational groups accounted for more than 40% of all accidental injury hospitalizations occurring among cruiser personnel. Seaman and airman personnel serving aboard conventional carriers showed significantly higher risks of injury than their counterparts serving aboard nuclear carriers. Risks did not differ by external cause of accident or by duty status at the time of injury.

Conclusions

Comparison of injury hospitalization data among the four ship groups revealed that duty aboard conventionally powered aircraft carriers and cruisers significantly increased an individual's risk of accidental injury. This study strengthens the hypothesis that the shipboard environment is a major risk factor for accidental injuries and that shipboard working conditions and job assignments interact with experience and seniority to modify risk.

Hospitalizations for Accidents and Injuries in the U.S. Navy:
IV. A Comparison of Nuclear and Conventionally Powered Surface Ships

INTRODUCTION

Occupational safety and health is of continuing concern to both private industry and the military. At present more than 2.5 million workdays are lost annually in the United States due to injury and disease (Statistical Abstract of the United States, 1982). Because the magnitude and severity of the risks of accidental injury presumably depend upon the particular physical, chemical, or biological hazards associated with each occupation and work environment and the protective and preventive measures in place to reduce such risks, interpretation of relationships between these factors and host characteristics is a complex task. Large military organizations, such as the U.S. Navy, with relatively complete and accurate records of disease and serious injury occurrence, can provide useful data concerning the incidence and principal interacting variables involved in occupationally related hospitalizations.

The work environment contains many stressors and hazards that can induce injury; job demands, work activities, and environmental exposures all vary widely as a function of occupation and level of responsibility and seniority. A recent study by Helmkamp and Bone (1986) indicated that the shipboard environment was a major risk factor for on-duty accidents and injuries, especially among personnel assigned to destroyers, replenishment ships, and conventionally powered aircraft carriers.

An important aspect of occupation is job experience or seniority. Several recent studies have shown that accident rates generally decrease with increasing levels of job responsibility (Helmkamp and Bone, 1986; Ferguson, McNally, Booth, 1985). These studies examined the relationship between accident risk and paygrade (a variable that reflects seniority, specific authority, and defined privileges and responsibility in the military) within particular Navy occupational fields.

An inverse linear relationship was consistently found between injury rate and paygrade; however, the strength of the relationship varied by specific occupation, suggesting that experience and familiarity with the work environment may not moderate risks to the same degree in all occupational fields. Helmkamp and Bone (1985) reported that although paygrade level was influential, the amount of time a man spent in a new job assignment was also related to accidental injury occurrence. The greatest number of injuries among shore-based personnel occurred within the first month of reporting to a new duty station and then decreased dramatically after this period, suggesting that the protective effects previously associated with seniority and experience may be largely negated by the lack of familiarity of personnel with their new work environment.

Although a variety of adverse health effects have been attributed to conditions commonly encountered in shipboard environments, they have not been clearly related to individual and demographic factors of a ship's crew. In this study, accidental injury hospitalization rates are calculated for personnel assigned to two major ship types--cruisers and aircraft carriers. These ships are further classified as nuclear or conventionally powered. The rates among nuclear ship personnel will then be compared to the rates experienced by their non-nuclear counterparts. Since the ships being compared had similiar mission specifications and crews, differing only by the age

of the ship and the means of propulsion, the effect that these environmental variables may have had on individual factors and subsequent injury hospitalization can be directly assessed.

METHODS

Data Files

The Naval Health Research Center (NHRC) has several unique data bases that can be utilized for epidemiologic research. These databases include comprehensive population, service, and medical history files containing information on more than 2,800,000 enlisted members of the U.S. Navy who have been or still are on active duty between January 1, 1965 and December 31, 1984.

Study Population

This study was conducted as a three year cross-sectional investigation covering the years 1977-1979. Participants in the study included all male enlisted personnel who served exclusively aboard conventionally or nuclear powered aircraft carriers and cruisers. Cases were identified from the medical history file as those enlisted men who had suffered an accidental injury that resulted in a hospitalization, a Medical Board, a Physical Evaluation Board, or death (N = 2704). The term "hospitalization" will be used throughout this report to collectively describe these outcome events. To lessen confounding bias, the 112 men who were identified (on their service history files) as having served aboard both carriers and cruisers or both conventionally and nuclear powered ships (88 conventional and 24 nuclear crewmen) were excluded from the study. Hospitalizations were coded in accordance with the eighth revision of the International Classification of Diseases, Adapted for Use in the United States (ICDA)--codes 800-999. Purposely self-inflicted, combat, or assault related injuries were not included. Additional classifications were available to further describe the circumstances of individual hospitalizations: 1) type of ship to which an individual was assigned at the time of hospitalization, 2) external cause of accident, 3) seniority (reflecting the paygrade at the time of hospitalization), 4) age, 5) race, 6) occupation, and 7) duty status at the time of injury (on- or off-duty). Age, race, paygrade, occupation, and ship assignment information were obtained from the service history data file. Population (denominator) data of all personnel on similar class ships was obtained from the population data file. A list of the average annual population at risk for each ship type by age, race, paygrade, and occupational subgroup is presented in Table 1.

Analyses

Subgroup specific injury hospitalization rates were computed for each ship type by taking the average annual number of hospitalizations among personnel in each group and dividing it by the appropriate annual subgroup population from which the cases were derived. The following formula was used to calculate these rates (Monson, 1980):

$$\text{Hospitalization Rate} = \frac{\text{Average number of hospitalizations for specific group}}{\text{Average population for specific group}} \times 1{,}000$$

Table 1
Cohort Characteristics of
U.S. Navy Personnel Serving Aboard Conventionally
and Nuclear Powered Ships, 1977-1979

Variable	Conventional Carrier Number	%Pop	Nuclear Carrier Number	%Pop	Conventional Cruiser Number	%Pop	Nuclear Cruiser Number	%Pop
Age Group								
≤19 years	5130	20	1403	17	1505	16	466	11
20-24 years	14142	54	4583	56	5158	55	2513	58
25-29 years	3146	12	1141	14	1267	13	740	17
30-34 years	1886	7	576	7	831	9	347	8
35-39 years	1428	5	418	5	521	6	202	5
≥40 years	485	2	121	1	132	1	52	1
Race								
White	21060	80	6850	83	7880	84	3803	88
Black	3125	12	977	12	908	10	345	8
Other	2032	8	412	5	626	6	172	4
Paygrade								
E1	1578	6	427	5	342	4	128	3
E2	5436	21	1464	18	1501	16	439	10
E3	7538	29	2016	24	2390	25	767	18
E4	5269	20	1634	20	2232	24	965	23
E5	2956	11	1452	18	1499	16	1216	28
E6	2231	9	857	10	856	9	530	12
E7	914	3	297	4	457	5	217	5
E8, E9	295	1	95	1	137	1	58	1
Occupation								
Seaman	3048	12	989	12	1363	14	518	12
Logistics	1421	5	438	5	492	5	206	5
Ship Operations	1451	6	428	5	1168	12	406	9
Ship Maintenance	879	3	267	3	338	4	151	4
Admini-stration	882	3	293	4	266	3	116	3
Healthcare	353	1	130	2	77	1	40	1
Marine Engineer	4123	16	1498	18	1952	21	1220	28
Engineerman	1942	8	430	5	457	5	15[illegible]	4
Airman	3245	12	919	11	N/A	--	N/A	--
Aviation Maintenance and Weapons	1899	7	566	7	N/A	--	N/A	--
Other	6974	27	2284	28	3301	35	1508	34
Total	26217	100	8242	100	9414	100	4320	100

These rates were adjusted to the total Navy population for age by the direct method (Daniel, 1983) to help reduce potential bias and allow more valid rate comparisons between ship types. Since previous research has shown that age and paygrade level are highly correlated (rho = 0.73, $p < .001$), age-adjustment also removed any confounding bias that may have been caused by uneven paygrade distributions (Helmkamp and Bone, 1986).

The rates for the various groups were then compared to obtain the relative risk of hospitalization by taking the ratio of rates for subgroups aboard conventionally powered ships to rates for subgroups aboard nuclear powered ships. Levels of significance for the relative risk associations were obtained using 95% confidence intervals calculated from the following formula using the Yates corrected Chi-square statistic (Miettinen, 1976):

95% Confidence Interval = $\exp [R (1 \pm 1.96/x)]$

where: $R = \ln$ [relative risk]

$x = \sqrt{X^2}$ Yates corrected Chi-square statististic (Schlessleman, 1982)

If the 95% confidence interval did not include 1.0, then it was concluded that the hospitalization rates between the two groups differed significantly from each other.

RESULTS

Accidental injury hospitalization rates and relative risks by age group and ship type are presented in Table 2.

Table 2

Accidental Injury Hospitalization Rates and Relative Risks by Age Group, 1977-1979

Age Group	Conventional Carriers Number	Conventional Carriers Rate/1000	Nuclear Carriers Number	Nuclear Carriers Rate/1000	Relative Risk	Significance
≤19 years	173	33.7	33	23.5	1.4	N.S. (p >.05)
20-24 years	330	23.3	70	15.3	1.5	(1.2, 1.9)
25-29 years	59	18.8	13	11.4	1.6	N.S. (p >.05)
30-34 years	26	13.8	4	6.9	2.0	N.S. (p >.10)
35-39 years	16	11.2	1	2.4	4.7	N.S. (p >.05)
≥40 years	4	8.2	1	8.3	1.0	N.S. (p >.10)
Total	608	22.4	122	14.4	1.6	(1.3, 2.0)
	Conventional Cruisers		Nuclear Cruisers			
≤19 years	34	22.6	4	8.6	2.6	N.S. (p >.05)
20-24 years	88	17.1	18	7.2	2.4	(1.4, 4.0)
25-29 years	15	11.8	2	2.7	4.4	N.S. (p >.05)
30-34 years	9	10.8	1	2.9	3.7	N.S. (p >.10)
35-39 years	2	3.8	1	5.0	0.8	N.S. (p >.10)
≥ 40 years	1	7.6	0	0	---	*N.C.
Total	149	15.6	26	6.1	2.6	(1.7, 4.0)

* Not Calculable

Only the 20-24 year age group exhibited significant differences in injury hospitalization risk for both conventional carrier and cruiser personnel comparisons. This risk was 1.5 and 2.4 times the risk of hospitalization, respectively, for the same aged personnel serving on nuclear ships. Combined hospitalization data, used to calculate total rates, indicated that conventional carrier and cruiser personnel are 1.6 and 2.6 times more likely, respectively, to suffer a serious accidental injury than their counterparts serving aboard nuclear vessels.

Comparisons of incidence rates were made by paygrade to ascertain if seniority affected the relative frequency of injury-related hospital events between conventionally and nuclear powered ship crews. Table 3 summarizes these rates and the relative risks for injury hospitalizations by paygrade level for each ship type.

Table 3
Accidental Injury Hospitalization Rates and Relative Risks by Paygrade, 1977-1979

Paygrade	Conventional Carriers Number	Rate/1000	Nuclear Carriers Number	Rate/1000	Relative Risk	Significance
E1	73	46.3	5	11.7	4.0	(1.2, 9.5)
E2	142	26.1	30	20.5	1.3	N.S. (p >.10)
E3	199	26.4	44	21.8	1.2	N.S. (p >.10)
E4	106	20.1	20	12.2	1.6	N.S. (p >.05)
E5	45	15.2	14	9.6	1.6	N.S. (p >.05)
E6	30	13.4	6	7.0	1.9	N.S. (p >.05)
E7	11	12.0	2	6.7	1.8	N.S. (p >.10)
E8, E9	2	6.8	1	10.5	0.6	N.S. (p >.10)
Total	608	22.4	122	14.4	1.6	(1.3, 2.0)
	Conventional Cruisers		Nuclear Cruisers			
E1	5	14.6	0	0	---	*N.C.
E2	27	18.0	4	9.1	2.0	N.S. (p >.10)
E3	58	24.3	9	11.7	2.1	N.S. (p >.05)
E4	32	14.3	5	5.2	2.8	(1.01, 7.5)
E5	16	10.7	6	4.9	2.2	N.S. (p >.05)
E6	7	8.2	1	1.9	4.3	N.S. (p >.10)
E7	4	8.8	0	0	---	*N.C.
E8, E9	0	0	1	17.2	---	*N.C.
Total	149	15.6	26	6.1	2.6	(1.7, 4.0)

*Not Calculable

Only two groups showed differences in injury hospitalization rates between ship types by seniority. E1's, mostly junior personnel reduced in paygrade for disciplinary reasons, exhibited the only significant rate differential (relative risk = 4.0) observed among conventional

carrier personnel. E4 personnel serving aboard conventional cruisers showed marginal significance in their risk of hospitalization (relative risk = 2.8) when compared to nuclear cruiser personnel of the same paygrade. The lower 95% confidence limits for these relative risks were close to 1.0; therefore, caution should be used when interpreting excess risk from the above incidence rate comparisons.

Table 4

Accidental Injury Hospitalization Rates and
Relative Risks by Occupation and Ship Type, 1977-1979

Occupation	Conventional Carriers Number	Conventional Carriers Rate/1000	Nuclear Carriers Number	Nuclear Carriers Rate/1000	Relative Risk	Significance
Seaman	110	36.1	18	18.2	2.0	(1.2, 3.1)
Logistics	35	24.6	6	13.7	1.8	N.S. (p >.10)
Ship Operations	36	24.8	9	21.0	1.2	N.S. (p >.10)
Ship Maintenance	24	27.3	6	22.5	1.2	N.S. (p >.10)
Admini-stration	11	12.5	1	3.4	3.7	N.S. (p >.10)
Healthcare	13	36.8	1	7.7	4.8	N.S. (p >.05)
Airman	88	27.1	10	10.9	2.5	(1.3, 4.8)
Aviation Maintenance and Weapons	39	20.5	11	19.4	1.1	N.S. (p >.10)
Marine Engineer	93	22.6	18	12.0	*	
Engineerman	59	30.4	11	25.6	*	
Other	100	14.3	31	13.6	1.1	N.S. (p >.10)
Total	608	22.4	122	14.4	1.6	(1.3, 2.0)
	Conventional Cruisers		Nuclear Cruisers			
Seaman	38	27.9	6	11.6	2.4	N.S. (p >.05)
Logistics	8	16.3	2	9.7	1.7	N.S. (p >.10)
Ship Operations	14	12.0	2	4.9	2.4	N.S. (p >.10)
Ship Maintenance	3	8.9	1	6.6	1.3	N.S. (p >.10)
Admini-stration	3	11.3	1	8.6	1.3	N.S. (p >.10)
Healthcare	2	26.0	1	25.0	1.0	N.S. (p >.10)
Marine Engineer	33	16.9	5	4.1	*	
Engineerman	10	21.9	2	12.9	*	
Other	38	11.5	6	4.0	2.9	(1.2, 7.0)
Total	149	15.6	26	6.1	2.6	(1.7, 4.0)

*Groups not comparable

Distribution of hospitalization events by occupational assignment was analyzed to determine if certain job categories were responsible for the majority of hospitalizations occurring in conventional and nuclear ship environments. Appendix A provides a brief description of the occupational groups analyzed in this portion of the investigation. Frequencies, hospitalization rates, and relative risks by occupational group and ship type are presented above in Table 4.

One-third of all injury-related hospitalizations occurring among conventional and nuclear carrier personnel were distributed among the marine engineer and seaman job categories. These same occupational groups accounted for more than 40% of all accidental injury hospitalizations occurring among conventional and nuclear cruiser personnel.

Seaman and airman personnel serving aboard conventional carriers had significantly greater risks of being hospitalized by an injury (relative risks = 2.0 and 2.5, respectively) than crew members in the same occupations serving aboard nuclear carriers. Only one group (the "other" category) showed significant differences in hospitalization rates (relative risk = 2.9) between conventional and nuclear cruiser personnel.

Hospitalization events were further categorized by external cause of accident and by duty status (on- or off-duty). The two primary causes of on-duty injury hospitalization across all four ship types were falls and machinery related accidents. Athletic, motorcycle, and automobile accidents were responsible for approximately one-half of all off-duty injury hospitalizations. Hospitalization rates from these causes did not differ significantly between conventional and nuclear crews.

DISCUSSION

The validity of comparing nuclear aircraft carrier crews to conventional aircraft carrier crews or nuclear cruiser crews to conventional cruiser crews was of primary importance in this study. According to Hall and associates (1976), in a technical report concerning the qualifications of engineering personnel on nuclear powered ships, the actual work of maintenance and repair of the nuclear power plant system was not different in kind from the usual electronic, mechanical, and hydraulic maintenance and repair work that occurs in the engineering spaces of any large conventionally powered ship. The only significant difference noted for working with nuclear power was in the precautions required to assure that the work would not negatively effect the integrity of the system and in the special radiation protection requirements that might be associated with certain repairs. Any major maintenance and repair work that differed from the norm (e.g. refueling and core replacement) was performed by highly trained technicians at specialized repair facilities--ship personnel were not expected to perform such work.

However, according to the Naval Recruiting Command (1984), eligibility for enlistment as a nuclear engineer is highly selective. Applicants must: 1) be high school graduates with at least a "C" average and have completed one year of algebra, 2) be between 17 and 25 years of age, 3) receive greater than 64 on the Armed Forces Qualification Test and greater than 47 on the Nuclear Field Qualification Test, 4) have no prior drug usage, and 5) have limited civil involvement (no more than five traffic violations and one misdemeanor). As recruits, they receive intensive and highly technical training on nuclear propulsion systems and later have opportunities for accelerated promotions and salary incentives to encourage re-enlistment.

Clearly, nuclear engineers are different from conventional engineers in selection, training, and incentives. Because of these differences and the difficulty in adequately controlling for them, comparisons between these two groups were not made. All other occupational categories aboard nuclear powered ships appeared to be similiar to their counterparts aboard conventionally powered ships, so rate comparisons were justified with regard to these groups.

Interpretation of Results

Comparison of injury hospitalization data among the four ship groups revealed that duty aboard conventionally powered aircraft carriers and cruisers significantly increased an individual's risk of accidental injury. Further analysis of the data revealed only a few differences between cohorts when rates were compared across various age, paygrade, and occupational categories.

Differences observed in injury hospitalization rates among personnel assigned to conventionally powered ships may be explained, in part, by the relative age of the ships. A majority of the conventional carriers were under construction during the late 1940's and early 1950's using specifications based on World War II designs. The nuclear vessels studied in this paper were built more recently--in the late 1960's and early 1970's--thereby benefitting from research in habitability, environmental controls, and ergonomic design (Polmar, 1978). Hazards such as excessive noise, heat, and exhaust fumes, usually associated with heavy machinery and combustion engines, may play a fundamental role in accident occurrence, exerting a pervasive influence upon risk of hospitalization.

Better crew accommodations, greater space availability, newer machinery and ship facilities utilizing modern ergonomic principles, suggests a safer, less hazardous living and working environment onboard nuclear ships, thereby decreasing the potential risk of injury.

The relatively high rate of accidental injury hospitalizations observed in the seaman and airman occupational groups for conventional carrier personnel may largely be a reflection of age and immaturity effects, since these occupations were mostly composed of younger, inexperienced personnel.

Biases

Caution must be exercised when interpreting excess hospitalization in the populations that were studied. Although the increased relative risk observed among conventional carrier and cruiser personnel is unlikely to be a chance event, automatic attribution to environmental exposure is not warranted. Several biases may have influenced the observed associations.

Variations were found in age, paygrade, and occupational distributions between the four populations. All hospitalization rates were age (and paygrade) adjusted prior to the determination of excess risk, so bias attributable to age or paygrade differences should not affect the results. The only two occupational groups that showed significant population differences between the ship types--marine engineers and engineerman--were excluded from the occupational comparisons because of qualification and education differences in the personnel. Marine engineer and engineerman hospitalization data were not, however, excluded from the age and paygrade comparisons. Since approximately one-quarter of all hospital admissions in each cohort were among men in these two groups, some confounding bias may have occurred.

Another confounding factor may stem from duty selection practices in the Navy. Within the same job category, assignment to a highly desirable duty station is usually done by merit; those individuals who scored high on aptitude tests, or were in some way more outstanding than their peers, will generally have their duty assignment requests filled first, based on the needs of the Navy. Duty aboard nuclear powered ships may be considered more prestigious than duty aboard conventional ships; therefore, selection by merit could result in nuclear ships being manned by superior personnel, leading to a "selection of the fittest" bias.

Classification biases were also possible. Occupational job codes were used to approximate work activities; precise tasks of individuals serving onboard the vessels was not determined. It is plausible that men classified in certain occupational groups aboard conventional ships did not perform work tasks identical to those performed by men in the same occupational group aboard nuclear ships. For example, seaman who served aboard the older conventionally powered ships may have been constantly involved in deck maintenance and repair or other physically demanding work, while seaman serving aboard nuclear powered ships may have needed to perform these strenuous tasks less frequently.

CONCLUSIONS

Comparison of injury hospitalization data among the four ship groups revealed that duty aboard conventionally powered aircraft carriers and cruisers significantly increased an individual's risk of accidental injury. This study strengthens the hypothesis that the shipboard environment is a major risk factor for accidental injuries and that shipboard working conditions and job assignments interact with experience and seniority to modify risk.

Further research using more recent data is needed to determine if hospitalization rate differences change with the implementation of the Service Life Extension Program (SLEP) for carriers. The SLEP (begun in the early 1980s) is designed to extend the service life of older carriers by 10 to 15 years by modernizing the ships during a complete overhaul (Polmar, 1978). Comparison of nuclear carrier personnel hospitalization data with the hospitalization data of personnel serving on the newly overhauled conventional carriers will clarify the effects of the age of the ship and its state of repair on accidental injury risk.

Appendix A

Description of Navy Occupational Categories

Occupational Category		Description
Logistics	Includes:	storekeeper; disbursing clerk; ship's serviceman
	General Duties:	supply management; maintain and inventory payroll, retail, and personal service facilities
Ship Operations	Includes:	boatswain's mate; signalman; quartermaster
	General Duties	seamanship and navigation; maintain and operate visual signal equipment, cargo handling equipment, small boats
Aviation Maintenance/ Weapons	Includes:	aviation machinist's mate; aviation electronic technician; aviation structural mechanic; aviation ordnanceman
	General Duties:	maintain and repair aircraft engines, electrical equipment, and structural parts of aircraft; load and unload aircraft armaments
Ship Maintenance	Includes:	precision instrumentman; opticalman; electrician's mate; hull maintenance technician
	General Duties:	maintain and repair small machines and optical equipment; work metal and manufacture machinery parts
Administration	Includes:	yeoman; personnelman
	General Duties:	secretarial and office work
Healthcare	Includes:	hospital corpsman; dental technician
	General Duties:	provide routine and emergency medical care
Marine Engineer	Includes:	machinist's mate; engineman; machinery repairman; boiler technician
	General Duties:	operate and maintain heavy machinery, propulsion equipment, and electrical components of engines; operate marine boilers
Seaman	Includes:	seaman recruit; seaman apprentice; seaman (this is an unskilled job category for men training for deck, ordnance, administration, or ship operations specialties)
	General Duties:	miscellaneous tasks usually physically oriented and labor intensive e.g., clean and maintain ship, wash kitchenware, etc.
Airman	Includes:	airman recruit; airman apprentice; airman (this is an unskilled job category for men training for aviation specialties)
	General Duties:	miscellaneous tasks e.g., maintain and clean aircraft, hangars, and equipment
Engineerman	Includes:	engineer recruit; engineer apprentice; engineerman (this is an unskilled job category for men training for engineering or hull maintenance specialties)
	General Duties:	miscellaneous tasks e.g., maintain and clean engine rooms, equipment, etc.
Other	Includes:	communication and intelligence; mess management; ordnance systems; media; weapons control
	General Duties:	varied

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The relative incidence of accidental injury hospitalization among Navy enlisted men serving aboard conventionally or nuclear-powered aircraft carriers and cruisers was analyzed by age, paygrade, and occupation. By comparing rates of injury between conventional- and nuclear-powered ship crews, differences in the rates of hosptialization were found for men in the 20-24 year age group, with conventional crewmen showing a greater risk of injury than nuclear crewmen. When looking at the effects of the ship environments and seniority, E1's serving aboard conventional carriers and E4's serving aboard conventional cruisers had

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significantly higher rates of accidental injury hospitalization than nuclear personnel in the same paygrades. Nearly 1/3 of all injury-related hospitalizations occurring among conventional- and nuclear-carrier personnel were distributed among the marine engineer and seaman job categories. These same occupational groups accounted for more than 40% of all accidental injury hospitalizations occurring among cruiser personnel. Seaman and airman serving aboard conventional carriers showed significantly higher risks of injury than their counterparts serving aboard nuclear carriers. Risks did not differ between the ship types by external cause of accident or by duty status at the time of injury.

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